G.1 BMP SELECTION PROCESS FOR PROJECT PLANNING AND DESIGN

In planning a development project, the designer must answer three key questions with respect to storm water quality control: (1) what kind of storm water quality controls are needed?; (2) where should the controls be implemented?; and (3) how much control is enough? In order to answer these questions, the designer should document the process used to identify potential storm water quality problems, develop design objectives, formulate and evaluate alternatives, select the most appropriate alternatives, and design the plan.

A list of recommended BMPs for development planning and design has been compiled, and a process has been identified for selecting the appropriate BMPs for a specific project. This list of BMPs and the selection process are appropriate for use in addressing site planning issues and post-construction site uses for development projects. BMPs should be selected based upon criteria such as: type of development and its related potential for contributing to storm water pollution, environmental benefit to be gained, pollutant removal effectiveness, economic and technical feasibility, ease of maintenance for ongoing implementation of BMPs, and consistency with other environmental mandates.

The recommended BMP selection process is described in Sections G.2 through G.6. The recommended BMPs for consideration for planning and design projects are provided in Section G.7.

G.2 DEVELOP GOALS AND OBJECTIVES

Site-specific conditions of development planning projects determine which BMPs are most appropriate for a site. Prior to selecting BMPs, a good understanding of post-construction activities and potential sources of storm water pollutants is needed. The BMPs considered should address the potential pollutants reasonably expected at the site once the site is occupied or operational. The permanent BMPs planned for a site should fulfill the following goals and objectives:

- be appropriate for the given site constraints;
- ease of implementation and maintenance;
- ensure no adverse impacts to storm water quality;
- promote improved water quality;
- provide effective pollutant source control or removal capability;

- meet regulatory requirements; and
- be economically feasible.

G.3 BMP SELECTION CRITERIA

In order to fulfill the preceding goals and objectives, appropriate BMPs should be selected by using selection criteria that serve to identify the capabilities and limitations of each BMP. Common criteria used in screening and selecting BMPs during the planning stage are:

- project characteristics (e.g., potential sources of storm water pollutants after construction is completed);
- site factors (e.g., slope, high water table, soils, etc.);
- pollutant removal capability;
- short-term and long-term costs;
- responsibility for maintenance;
- contributing watershed; and
- environmental enhancement.

These criteria may be given equal weight during the BMP selection process, or they may be weighted differentially, depending on the relative importance of each factor for the particular project. These factors are described in more detail in Attachment G1.

G.4 SELECT BEST ALTERNATIVES

Using the list of recommended BMPs for Planning Priority Projects, the developer/designer should use the selection criteria described in Attachment 1 to select the best alternatives for the project conditions, characteristics, and concerns. This may be done numerically, by weighting the selection criteria, rating each BMP against each criterion, and summing up a weighted rating for each BMP, which then becomes a relative ranking. Or the selection process may be done in a more subjective, non-numerical way using experience and professional judgment to select the best alternative BMPs. Either way, the project designer should document the BMP selection process to provide justification for the system of BMPs incorporated into project plans and designs.

G.5 DESIGN AND INSTALLATION OF THE BMPS

After the appropriate BMPs are selected for a given project, the designer may complete the design of the BMPs and complete the project plans and specifications. Post-construction structural or treatment control BMPs for must be designed to:

A. Mitigate (infiltrate or treat) storm water runoff from either:

1. the 85th percentile 24-hour runoff event determined as the maximized capture storm water volume for the area, from the formula recommended in *Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998*), or
2. the volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in *California Stormwater Best Management Practices Handbook – Industrial/ Commercial,* (1993), or
3. the volume of runoff produced from a 0.75 inch storm event, prior to its discharge to a storm water conveyance system, or
4. the volume of runoff produced from a historical-record based reference 24-hour rainfall criterion for “treatment” (0.75 inch average for the Los Angeles County area) that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event,

AND

B. Flow Based Treatment Control BMP

(1) the flow of runoff produced from a rain event equal to at least 0.2 inches per hour intensity, or

(2) the flow of runoff produced from a rain event equal to at least two times the 85th percentile hourly rainfall intensity for Los Angeles County, or

(3) the flow of runoff produced from a rain event that will result in treatment of the same portion of runoff as treated using volumetric standards above.

Further, it is important that the project plans and specifications include adequate information for the BMPs to be properly installed. Improper installation is one of the most common reasons for water quality controls to not function as designed. Therefore, the designer must provide sufficient information in the project plans for their proper installation.

G.6 MAINTENANCE OF THE BMPS

Typically, maintenance of the permanent BMPs will not be the responsibility of the City, but will be the responsibility of the owner, occupant, owner's association, etc. However, maintenance is crucial to the proper and continued functioning and effectiveness of the BMPs. The developer or contractor must consider the ongoing maintenance responsibility required for each BMP selected.

G.7 RECOMMENDED BMPS

Table G-1 lists recommended BMPs as related to site planning practices, post-construction measures, and redevelopment and infill practices. Where applicable, the numerical designation for a BMP as used in the *California Storm Water Best Management Practices Handbook* is noted. Erosion control BMPs are included here because maintenance of soil stabilization measures is important on an ongoing basis (i.e., for the life of the site). A brief description of each BMP is provided in Attachment G2. BMP Fact Sheets for each of these BMPs are provided in Attachment G3.

Table G-1. Recommended BMPs

BMP Name	BMP Identification No. and Name[1]	Site Planning Practices	Post-Construction	Redevelopment & Infill Practices
Car Wash Facility	SC3, Vehicle and Equipment Washing and Steam Cleaning		x	x
Constructed Wetlands	TC3, Constructed Wetlands		x	
Control of Impervious Runoff	Not applicable.		x	x
Efficient Irrigation	Not applicable.		x	x
Energy Dissipaters	ESC40, Outlet Protection		x	x
Extended Detention Basins	TC5, Extended Detention Basin		x	
Infiltration Basins	TC1, Infiltration		x	x
Infiltration Trenches	TC1, Infiltration		x	x
Inlet Trash Racks	Not applicable.		x	x
Landscape Design	ESC2, Preservation of Existing Vegetation; ECS10, Seeding and Planting; ESC11, Mulching		x	x
Linings for Urban Runoff Conveyance Channel	Not applicable.		x	x
Materials Management	SC5, Outdoor Loading/Unloading of Materials; SC6, Outdoor Container Storage of Liquids; SC8, Outdoor Storage of Raw Materials, Products, and By-Products		x	x
Media Filtration	TC6, Media Filtration		x	x
Minimize Storm Water Runoff	Not applicable.	x		
Motor Fuel Concrete Dispensing Areas	SC2, Vehicle and Equipment Fueling		x	x
Motor Fuel Dispensing Area Canopy	SC2, Vehicle and Equipment Fueling		x	x
Oil/Water Separators and Water Quality Inlets	TC7, Oil/Water Separators and Water Quality Inlets		x	x
Outdoor Storage	SC6, Outdoor Container Storage of Liquids; SC8, Outdoor Storage of Raw Materials, Products, and By-Products		x	x
Pervious Drainage System	Not applicable.	x		
Porous Pavement and Alternative Surfaces	TC1, Infiltration		x	x

Table G-1. Recommended BMPs (continued)

BMP Name	BMP Identification No. and Name[1]	Site Planning Practices	Post-Construction	Redevelopment & Infill Practices
Protect Slopes and Channels	ECS40, Outlet Protection; ESC42, Slope Roughening and Terracing		x	x
Reduce Area of Impervious Surface	Not applicable.	x		
Self Contained Areas for Vehicle or Equipment Washing, Steam Cleaning, Maintenance, Repair, or Material Processing	SC3, Vehicle and Equipment Washing and Steam Cleaning; SC4, Vehicle and Equipment Maintenance and Repair; SC7, Outdoor Process Equipment Operations and Maintenance		x	x
Site Layout	Not applicable.	x		
Storm Drain System Stenciling and Signage	SC30, Storm Drain System Signs		x	x
Trash Container Areas	SC9, Waste Handling and Disposal		x	x
Vegetated Swales and Strips	TC4, Bio-filters		x	x
Wet Pond	TC2,Wet Pond		x	

1 Corresponds to the BMP number and name as in the *California Storm Water Best Management Practice Handbooks* (1993).

G.8 STANDARD URBAN STORM WATER MITIGATION PLAN

Selection of permanent (post-construction) BMPs for a project is a function of the type, size, and location of the project. Projects developed on large sites provide the opportunity to incorporate a wide variety of BMPs, whereas smaller sites may present physical constraints on the implementation of BMPs requiring allocation of larger land areas. Similarly, for projects located in an existing urban environment (for example, redevelopment or infill projects), opportunities may not exist to implement BMPs that focus on the preservation of existing natural vegetation.

A development and redevelopment projects that fall into one of the nine following categories are subject to the requirements of the SUSMP:

- Single-Family Hillside Home
- Ten or more unit home (includes single family homes, multifamily homes, condominiums, and apartments)
- A 100,000 or more square feet of impervious surface area industrial/commercial development (1 Ac. starting March 10, 2003)
- Automotive service facilities
- Retail gasoline outlets
- Restaurants
- Parking lots 5,000 square feet or more of surface area or with 25 or more parking spaces
- Redevelopment projects in subject categories that meet Redevelopment thresholds; and
- Projects located or directly adjacent to or discharging directly to an ESA that meet threshold conditions.

A copy of the SUSMP is available at the City's public counter.

Attachment G1
Developer Information For Project Planning And Design

The following criteria should be considered during the process of assessing the appropriateness (benefits and limitations) of BMPs for a particular project:

- project characteristics;
- site factors;
- pollutant removal capability;
- short-term and long-term costs;
- responsibility for maintenance;
- contributing watershed area; and
- environmental enhancement.

G1.1 PROJECT CHARACTERISTICS

Selection of BMPs for a project is a function of project characteristics such as type or size of project. Post-construction activities and operations that may be potential sources of storm water pollution are often the same for a given type of project. Projects developed on large sites provide the opportunity to incorporate a wider variety of BMPs, whereas smaller sites often have physical constraints precluding implementation of BMPs requiring large land areas.

G1.2 SITE FACTORS

Site factors have common physical restrictions on BMPs and include:

Steep Slopes: Steep slopes restrict the use of several BMPs. Porous pavement must be situated in sites with slopes of 5 percent or less. Swales can only be used if their slope is less than 5 percent; however, swales often can be used perpendicular to the slope or with a drop structure. Also, because of slope stability concerns, infiltration trenches and filter strips are not practical when slopes exceed 20 percent.

High Water Table: The water table acts as an effective barrier to exfiltration and can sharply reduce the ability of an infiltration BMP to drain properly. If the height of the seasonally high water table extends to within 4 feet (1.2 meters) of the bottom of an infiltration BMP, the site is seldom considered suitable. Given the climate and geology of Southern California, this is typically not an issue, except for some areas adjacent to surface water bodies.

Soil Permeability: The type of soil is an important characteristic that can limit the applicability of a particular BMP at a particular site since the long term percolation rate is governed by soil type. This soil permeability factor is particularly relevant to infiltration BMPs, which should not be applied to sites with infiltration rates of less than 0.27 inch per hour (0.686 centimeters), as defined by the least permeable layer in the shallow soil profile. This limiting rate excludes most "C" and "D" soils (Soil Classification System), which cannot exfiltrate enough runoff through the subsoil. In addition, extremely permeable sandy soils may not maintain adequate water levels in wet ponds

Proximity to Foundations and Wells: Since infiltration BMPs divert runoff back into the soil, some development sites may experience difficulty with local seepage, especially if located near a building foundation. Another risk due to diverted runoff through infiltration may be contamination of groundwater supplies. Limited research has been performed to evaluate this risk, however, it is advisable to maintain infiltration BMPs at least 100 feet (30 meters) from drinking water wells. The risk is greater when shallow soils with organic materials are bypassed.

Climatic Region: BMPs should include appropriate designs to address issues of rainfall volume and intensity during wet weather seasons so as to consider the economic feasibility of using such BMPs and/or designs. Typically, the evaluation of long term rainfall records must be considered together with site conditions to properly size structural treatment BMPs.

In addition, wet ponds require some continuous flow (dry weather water source) to keep them from stagnating or developing odor and mosquito problems.

Land Consumption: Some sites are too intensively developed or limited in area to allow for some BMPs, such as pond BMPs and porous pavement, which require a large surface area and buffer area.

Maximum Depth: To preserve storage capacity for subsequent rain events, keep water from stagnating, and provide optimal pollutant removal conditions, infiltration BMPs must be designed to completely drain within 2 to 3 days after a storm. If the infiltration rates of the underlying soils are slow, the available depth of the infiltration facility may be limited. These restrictions vary depending on whether the facility is a trench, basin, injection well, or porous pavement.

Restricted Land Uses: Certain BMPs can only be applied to particular land uses, and are not broadly applicable for all development sites. Porous pavement can only be used for sites with parking lots not expected to receive heavy car or truck traffic, or much sediment.

High Sediment Input: Most BMPs are unable to handle the large loads of sediment that may be generated during the construction phase of development. Infiltration BMPs are particularly susceptible to rapid clogging and subsequent failure if significant sediment loads are allowed to enter the structure. As a general rule, these BMPs should not be installed until all of the land to be disturbed by construction in the contributing watershed is effectively stabilized and will remain stabilized. Contractors must often take unusual steps during the actual installation of the infiltration BMPs to prevent soil compaction or contamination by sediment. To prevent clogging of the infiltration BMPs after construction, many designs call for the use of a pre-treatment device to filter sediment and other coarse particles before they reach the infiltration BMP. In addition, in areas where large amounts of fine sediment may occur even in the absence of upstream construction, BMPs such as porous pavement are not recommended.

Landscape Enhancement: If properly designed, many BMP options have the potential to enhance the urban landscape. Wet ponds and wetlands are frequently used to create a waterfront effect in residential developments, and may actually increase the value of the adjacent property. Dry extended detention areas can serve as attractive parks, either manicured or natural in design, or sports fields. Given the typical rainfall patterns in Southern California, these open areas would be available for public use most of the year. Most infiltration BMPs or lined detention areas have a neutral or negative effect on landscape appearance. In general, BMPs may be visually attractive or aesthetically unappealing depending upon the creativity of the project designer.

G1.3 POLLUTANT REMOVAL CAPABILITY

The nature of the pollutant being removed and its concentration often sets an upper limit on the potential removal rate that can be achieved with a given BMP. The pollutant removal capability of a BMP is primarily governed by three interrelated factors: removal mechanisms as affected by the design of the BMP, fraction of the annual runoff volume that is effectively treated, and nature of the urban pollutant being treated.

Pollutants such as sediment and lead (which is typically bound to fine sediment) can be removed effectively by common BMP removal mechanisms, including settling and filtering. Soluble pollutants such as nitrate, phosphate, and some trace metals are more difficult to remove and require biological and/or chemical mechanisms, such as uptake by bacteria, algae, rooted aquatic plants, organic material, terrestrial vegetation, or soils.

G1.4 SHORT-TERM AND LONG-TERM COSTS

The appropriateness of a BMP for a particular site can be affected by short-term and long-term cost considerations. Short-term costs include installation costs for both materials and labor. Long-term costs include maintenance. To sustain proper function, some BMPs require low level maintenance on a regular and frequent basis, whereas other BMPs require infrequent maintenance of a more extensive nature. Maintenance costs will include the proper disposal of accumulated material. In selecting a control method, cost considerations—construction, installation, and maintenance—associated with the BMP should be considered.

G1.5 RESPONSIBILITY FOR MAINTENANCE

Improper maintenance is one of the most common reasons for water quality controls to not function as designed or to fail entirely. It is important to consider who will be responsible for maintenance of a permanent BMP, and what equipment is required to perform the maintenance properly.

G1.6 CONTRIBUTING WATERSHED AREA

The feasibility of a particular BMP depends on the contributing watershed area. A BMP cannot be practically suitable for all urban area sizes. For instance, wet pond BMPs generally require a significant contributing watershed area of greater than 10 acres (4 hectares), and in locales such as Southern California, a dry weather source of water. By contrast, infiltration and vegetative BMPs are applicable for catchments less than 10 acres (4 hectares), due to space, economic, or flow volume constraints.

It should be noted that the contributing watershed area does not have to be limited to the development project site. By using local topography and drainage, the contributing watershed area may be increased or decreased to better accommodate a particular BMP. For example, additional runoff generated away from the development project may be routed to the BMP, thereby increasing total catchment area and making pond options more feasible. Conversely, various portions of the total runoff from a development project site may be diverted to smaller, individual BMPs, thereby decreasing the contributing watershed area and making infiltration and vegetative BMPs more practical.

G1.7 ENVIRONMENTAL IMPACT AND ENHANCEMENT

Low Flow Maintenance: Downstream aquatic life may be jeopardized when the natural low flow levels experienced during the dry weather season decline even further because of reduced infiltration in urbanized watersheds. However, this is sometimes offset by irrigation return flows, which may cause unnatural dry weather flow. Infiltration BMPs can contribute significantly to groundwater recharge and may be able to help the watershed better mimic its past hydrologic behavior. Vegetative BMPs such as swales and filter strips appear to have modest potential in this regard, while pond BMPs have little effect in maintaining low flows.

Streambank Erosion Control: Streambank erosion not only contributes large sediment loads to receiving waters, but also has an adverse impact on the habitat quality for downstream aquatic life. Some BMPs, including extended detention ponds, and full exfiltration BMPs, can reduce erosive storm flows enough to keep downstream channels and banks relatively stable, whereas most other BMPs have only marginal capabilities in this regard.

Aquatic/Wildlife Habitat Creation: Some BMP options create wetland or open water areas utilized by waterfowl, marsh birds, and other wildlife. Shallow marshes and wet ponds are particularly well suited for this role, if relatively small investments are made in landscaping design and plant selection. Consideration would have to be given to a dry weather source of water, unless a seasonally wet area is desired. Terrestrial wildlife habitat may be created through the incorporation of BMPs such as wet ponds, extended detention ponds, infiltration basins, and filter strips. Relatively diverse biological communities may further be enhanced through judicious planting of trees, shrubs, and grasses that provide food and cover for the target wildlife.

Attachment G2
Developer Information For Project Planning And Design

G2.1 SOURCE CONTROL BMPS

Efficient Irrigation: The timing and application methods of irrigation water should be designed to minimize the runoff of excess irrigation water into the storm water drainage system. Rain shutoff devices should be employed to prevent irrigation after significant precipitation and to shut off before runoff occurs. Irrigation systems should be designed so areas that have different water use requirements are not mixed on the same station, to avoid over-watering problems. The use of drip irrigation should be considered for all planter areas that have a shrub density that will cause excessive spray interference of an overhead irrigation system. Flow reducers or shutoff valves triggered by a pressure drop should be used to mitigate broken heads or lines.

Energy Dissipaters: Energy dissipaters, such as riprap, shall be installed at the outlets of new storm drains that enter unlined channels in accordance with applicable agency specifications to minimize erosion. [*California Best Management Practice Handbook*: ESC40 - Outlet Protection]

Landscape Design: Choose plants with low irrigation requirements (for example, native or drought tolerant species) and group plants with similar water requirements in order to reduce excess irrigation runoff, where practical. Consider other design features, such as:

- Use mulches (such as wood chips or bark) in planter areas without ground cover to minimize sediment in runoff.
- Install appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant material where possible and/or as recommended by the landscape architect.
- Leave a vegetative barrier along the property boundary and interior water courses, to act as a pollutant filter, where appropriate and feasible.
- Choose plants that do not require fertilizer or pesticides to sustain growth.

[*California Best Management Practice Handbook*: ESC2 - Preservation of Existing Vegetation, ESC10 - Seeding and Planting, and ESC11 - Mulching]

Linings for Urban Runoff Conveyance Channels: Onsite conveyance channels should be lined, where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are large enough to erode grass or other vegetative linings, riprap, concrete soil cement or geo-grid stabilization may be substituted or used in combination with grass or other vegetation stabilization.

Materials Management: Project designs should be developed so as to minimize the potential of pollutants to contact rainfall or storm water runoff. Materials should be stored inside or under cover on paved surfaces. Secondary containment should be provided. The outdoor storage of hazardous materials should be minimized or eliminated. [*California Best Management Practice Handbook*: SC5 - Outdoor Loading/Unloading of Materials, SC6 - Outdoor Container Storage of Liquids, SC8 - Outdoor Storage of Raw Materials, Products, and By-Products]

Minimize Storm Water Runoff: Minimize the volume of post-development storm water runoff to an amount approximately equal to an undeveloped vegetated site by utilizing measures that increase infiltration. A reduction in the storm water runoff from a development project should yield a corresponding reduction in the amount of pollutants transported from the property. The undeveloped runoff volume should be determined by considering the project site to be in a natural condition with surface vegetation in place. The storm water runoff volume can be reduced by a variety of measures, including:

- increased use of landscape areas;
- increased use of vegetated drainage swales in lieu of underground piping or imperviously lined swales; and
- construction of onsite ponding areas or retention facilities to increase opportunities for infiltration.

Motor Fuel Concrete Dispensing Areas: Areas used for fuel dispensing shall be paved with portland cement concrete (or equivalent smooth impervious surface), and the use of asphalt concrete shall be prohibited. The fuel dispensing area shall have a 2% to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of storm water to the extent practicable. At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less. [*California Best Management Practice Handbook*: SC2 - Vehicle and Equipment Fueling]

Motor Fuel Dispensing Area Canopy: All motor fuel concrete dispensing areas must have a canopy structure. The canopy's minimum dimensions must be equal to or greater than the area within the grade break. The canopy must not drain onto the fuel dispensing area, and the canopy downspouts must be routed to prevent drainage across the concrete fueling area. [*California Best Management Practice Handbook*: SC2 - Vehicle and Equipment Fueling]

Outdoor Storage: Where proposed project building plans include outdoor areas for storage or use of containers of oils, fuels, solvents, coolants, wastes, or other chemicals, the areas where these materials are to be used or stored must be protected by secondary containment structures such as berms, dikes, or curbs, as well as a roof or awning to minimize collection of storm water within the secondary containment area. In cases where storage areas are will be contained but not covered with roof or awning, provisions must be made for proper disposal of storm water that collects in secondary containment due to potential contamination. [*California Best Management Practice Handbook*: SC6 - Outdoor Container Storage of Liquids, SC8 - Outdoor Storage of Raw Materials, Products, an By-Products]

Pervious Drainage System: Provide pervious drainage systems, where possible, to reduce the volume of runoff through the opportunity for storm water infiltration. The primary objective of pervious drainage systems is to allow the storm water to flow over a natural surface or other constructed pervious materials as much as practical, thereby increasing opportunities for infiltration and pollutant removal. Methods of providing such drainage include:

- discharge roof drains onto lawn or vegetated areas, and not directly into a storm drain system;
- provide vegetated drainage swales on the developed site;
- use natural water courses or unlined channels to convey storm water runoff;
- use open jointed paving materials in walkway or parking areas; and
- where soils conditions are suitable, use perforated pipe or gravel filtration pits for low flow infiltration.

Protect Slopes and Channels: Apart from approved grading plan areas, avoid disturbing steep or unstable slopes. Safely convey runoff from the tops of slopes, and stabilize disturbed slopes as quickly as possible. Avoid disturbing natural channels. Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in runoff velocity and frequency caused by the project do not erode the channel. [*California Best Management Practice Handbook*: ESC40 - Outlet Protection and ESC42 - Slope Roughening and Terracing]

Reduce Area of Impervious Surface: Reduce the area of impervious surfaces to minimize the storm water runoff volume and flow generated by the development project. The area of impervious surfaces in a development can be reduced by either reducing the physical size of the surface or by using a porous material for the paved surface. Some specific options to reduce impervious surfaces include:

- Provide reduced width sidewalks and incorporate landscaped buffer areas between sidewalks and streets. However, sidewalk widths must still comply with regulations for the Americans with Disabilities Act and other life safety requirements.
- Use permeable materials for sidewalk, driveway parking lot or roadway surfacing, where practicable.
- Reduce widths of street where off-street parking is available. However, street widths must still comply with life safety requirements for fire and emergency vehicle access.

Self-Contained Areas for Vehicle or Equipment Washing, Steam Cleaning, Maintenance, Repair, or Material Processing: For retail, commercial, or industrial development projects, self-contained areas shall be required for washing/steam cleaning, wet material processing, and maintenance activities. Specifically, where:

- washing of vehicles without steam cleaning occurs, provide wash racks constructed in accordance with local sewering agency guidelines or other acceptable standard, and obtain the prior approval of the sewering agency;
- steam cleaning occurs, provide wash racks or structurally contain (with a cover to restrict the entry of storm water during rain events) runoff from such areas on site for commercial waste removal;
- wet material processing occurs, secondary containment structures shall be provided to hold spills resulting from accidents, leaking tanks or equipment, or any other unplanned releases; and
- vehicle repair/maintenance occurs, impermeable berms, drop inlets, trench catch basins, or overflow containment structures shall be provided around repair/maintenance areas to prevent spilled materials and wash-down waters from entering the storm drain system.

[*California Best Management Practice Handbook*: SC3 - Vehicle and Equipment Washing and Steam Cleaning, SC4 - Vehicle and Equipment Maintenance and Repair, and SC7 - Outdoor Process Equipment Operations and Maintenance]

***Site Layout*:** Preserve natural drainage features, natural depression storage areas, and avoid development on steep hillside areas to the extent practicable. Consideration should be given to concentrating or clustering development on one part of a site while leaving the remaining land in a natural undisturbed condition. Clustering of development for a project entails decreasing the allowable lot size and set-back requirements while maintaining the number of allowable units on the site. Such an approach can provide the flexibility to locate buildings and development on areas of the property more suitable for the project while leaving areas of environmental value in an undeveloped or natural state. Clustering may reduce lengths of roads, walkways, driveways and other impervious surfaces, thereby reducing the amount of runoff from the project. More concentrated development may also provide opportunities to intercept and manage pollutants generated by the development.

Storm Drain System Stenciling and Signage: Storm drain inlets and catch basins shall be stenciled with prohibitive language and/or graphical icons to discourage illegal dumping. Signs with prohibitive language and/or graphical icons discouraging illegal dumping may also be posted along channels and creeks. All storm drain facilities constructed or modified will require the addition of standard stenciling or signage. [*California Best Management Practice Handbook*: SC30 - Storm Drain System Signs]

Trash Container Areas: Trash container areas, such as those for multi-family housing and commercial and industrial facilities, shall have drainage from adjoining roofs and pavements diverted around the area(s). Trash container areas shall be screened or walled to prevent off-site transport of trash, and shall have a solid roof or awning, where practicable. [*California Best Management Practice Handbook*: SC9 - Waste Handling and Disposal]

G2-2 TREATMENT CONTROL BMPS

Car Wash Facility: If a proposed project includes a designated car wash area, the area shall not discharge directly to the storm drain system. All wash water shall be directed to the sanitary sewer (with prior approval of the sewering agency), engineered infiltration device, or equally effective alternative. [*California Best Management Practice Handbook*: SC3, Vehicle and Equipment Washing and Steam Cleaning]

Constructed Wetlands: Create a wetland that is designed specifically for treating storm water runoff. A simple constructed wetland shall include a rectangular basin with a forebay and wetland vegetation area. The constructed wetland shall be shallower than a wet pond, allowing for greater contact between water, soil, and vegetation, and consequently, more phosphorus and metals removal potential. In Southern California, constructed wetlands would require a dry weather source of water. [*California Best Management Practice Handbook*: TC3 - Constructed Wetlands]

Control of Impervious Area Runoff: Direct drainage from impervious areas, including roofs, to the street or a storm drain shall be avoided. Impervious areas should be graded and constructed to drain to a filtration BMP, such as a landscaped area, infiltration area, detention basin or equally effective alternative, wherever practicable, and as recommended by the engineer of record. Roof runoff should also be directed to a filtration BMP, wherever practicable, and as recommended by the engineer of record. Some examples to control impervious runoff are:

- parking lot catch basins could be placed in landscaped areas, and roof downspouts could discharge onto landscaped areas which are designed to allow minor ponding
- site drainage systems could be designed to provide a low flow bypass into a filtration basin or similar BMP.

Extended Detention Basins: Provide an extended detention basin that fills with storm water runoff and then releases the storm water slowly through a bottom outlet to provide time for sediments to settle. Extended detention basins are dry between storm events. Extended detention basins are appropriate where dry weather base flow cannot be used to maintain water levels, as required in treatment BMPs such as wet ponds or constructed wetlands. These systems are suitable for any size tributary area. Extended detention ponds have lower removal efficiency than wet ponds and constructed wetlands with respect to particulate pollutants, and have less capability for dissolved contaminant removal. [*California Best Management Practice Handbook*: TC5 - Extended Detention Basin]

Infiltration Basins: Provide infiltration basins as effective means of removing both soluble and fine particulate pollutants borne in urban runoff. Coarse-grained pollutants should generally be removed before they enter the basin. Unlike other infiltration systems, basins can be easily adapted to provide a reduction of peak discharges for large design storms by storing flow. Depending on the degree of storage/exfiltration achieved in the basin, significant groundwater recharge, low flow augmentation and reduced streambank erosion can be achieved. Basins are a feasible option where soils are permeable and the water table and bedrock are situated well below the soil surface. Infiltration basins can serve relatively large drainage areas. However, infiltration basins that serve larger watersheds can be problematic because it becomes more difficult to control the sediment input. Both the construction costs and maintenance requirements for basins are similar to those for conventional dry ponds. Infiltration basins do need to be inspected regularly to check for standing water. [*California Best Management Practice Handbook*: TC1 - Infiltration]

Infiltration Trenches: Install infiltration trenches as adaptable BMPs that effectively remove both soluble and particulate pollutants from surface flows. As with other infiltration systems, trenches are not intended to trap coarse sediments. Grass buffers or special inlets must be installed to capture coarse sediment before it enters the trench. Depending on the degree of storage/exfiltration achieved, trenches can provide groundwater recharge, low flow augmentation and reduced streambank erosion. Individual trenches are primarily an on-site control, and are seldom practical or economical on sites with contributing areas larger than 5 to 10 acres (2 to 4 hectares). Infiltration trenches are only feasible when soils are permeable and the water table and bedrock are situated well below the bottom of the trench. Aside from regular inspection and effective upstream sediment and erosion control, trenches have limited routine maintenance requirements. However, trenches will prematurely clog if sediment is not kept out before, during, and after construction activities in the contributing drainage area. An infiltration trench will eventually clog and require periodic excavation and reconstruction. This BMP will typically not work in areas with predominantly fine-grained soils. [*California Best Management Practice Handbook*: TC1 - Infiltration]

Inlet Trash Racks: Install trash racks, gratings, screens or other devices in catch basins and inlet structures where appropriate to reduce the amount of debris, litter, and other trash entering a storm water system. The design and use of trash racks, screens or grates must consider hydraulic capacity requirements to prevent flooding. Because of the potential for flooding if a blockage occurs, prior to project approval or the issuance of permits, the development project should have a maintenance plan for the inlet trash racks, screens, and other devices for the portions of the storm drain system that do not revert to municipal ownership and operation.

Media Filtration: Use media filtration in watersheds where soils do not permit infiltration or where concerns over groundwater quality prevent the use of infiltration. Media filtration is a relatively new technique for treating storm water, whereby some portion of runoff is diverted onto a self-contained bed of sand or other media, often preceded by a small sediment basin. The runoff is then strained through the sand, collected in underground pipes and returned back to the stream or channel. This BMP has the following advantages: moderate to high pollutant removal capability; very few environmental limitations; small land requirement; and broad application to most development sites, large or small. Media filtration can be used on areas with thin soils, high evaporation rates, low soil infiltration rates, and limited space. Many media filtration devices have been used on small parking lots, and numerous media filtration devices have been used for municipal runoff. The required surface area of the filter is usually a direct function of the impervious area treated, and varies regionally due to rainfall patterns and local criteria for the volume needed for water quality treatment. A disadvantage of media filtration is that it does not provide storm water quantity control, unless coupled with detention. Media filtration systems are moderately expensive, and require the sand to be replaced every 1 to 3 years. [*California Best Management Practice Handbook*: TC6 - Media Filtration]

Oil/Water Separators and Water Quality Inlets: Provide oil/water separators or water quality inlets for situations where concentrations of oil, grease, and related compounds are high and not controlled effectively by source control methods. This type of treatment control is designed to remove petroleum compounds and grease, and is also capable of removing floatable debris and settleable solids. Businesses with a high likelihood of oil and grease concentrations include truck, car, and equipment maintenance and washing businesses, as well as facilities such as marinas, marine ports, airfields, and mass transit park-and-ride lots. Oil/water separators and water quality inlets are only effective with a prescribed and diligent maintenance program, and only if they are designed as off-line systems. [*California Best Management Practice Handbook*: TC7 - Oil/Water Separators and Water Quality Inlets]

Porous Pavement and Alternative Surfaces: Install porous pavement or an alternative surface which has a high capability to remove both soluble and fine particulate pollutants in urban runoff, and can also provide groundwater recharge, low flow augmentation, and reduction in streambank erosion. Installation of infiltration devices in conjunction with porous pavement allows capture of the runoff and percolation through the soil column. As the storm water percolates through the soil column, many pollutants are removed by filtration and soil bacteria. The use of porous pavement is generally restricted to low vehicle traffic volume and parking areas; it can accept runoff from rooftops or adjacent conventionally paved areas. As a BMP, porous pavement is only feasible on sites with gentle slopes, permeable soils, minimal (ideally no) sediment input, and relatively deep water table and bedrock levels. The disadvantages of porous pavement include the inability to bear heavy weight vehicles, the tendency to clog (which is costly to remedy), and the necessity of ongoing special maintenance to sustain function. Construction and installation of porous pavement also requires high levels of workmanship. [*California Best Management Practice Handbook*: TC1 - Infiltration]

Vegetated Swales and Strips: Install vegetated swales and strips to convey and treat storm water prior to discharge to a storm drain or surface water body. Treatment is achieved by sedimentation, filtration through the vegetation, adsorption to soil particles, and by bacteria present in the soil and on the plant stems. Vegetated swales are channels lined with grass that treat storm water flows. Swales are wider than typical storm water conveyance channels to maintain lower velocities and keep the depth of the water below the height of the vegetation (up to a particular runoff design flow rate). Implementation of vegetated swales is most appropriate for small drainage areas. Vegetated strips treat sheet flow and are placed parallel to the contributing surface, such as a parking lot. The strips should be greater than 10 feet (3 meters) long to establish sheet flow and should be sized to treat drainage areas of less than 5 acres (2 hectares). [*California Best Management Practice Handbook*: TC4 - Bio-filters]

Wet Pond: Install a wet pond where removal of dissolved constituents such as metals and nutrients are of concern. A wet pond is a small water body with rooted wetland vegetation along the perimeter that has a permanent water pool to treat incoming storm water. Wet ponds can be combined with extended detention basins. In Southern California, wet ponds require a dry weather source of water. [*California Best Management Practice Handbook*: TC2 - Wet Pond]

Attachment G3
Developer Information For Project Planning And Design
BMP Fact Sheets - California Best Management Practice Handbooks (1993)